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Grounds, Modality, and Nomic Necessity in the Critical Kant

Michela Massimi

8.1 Nomic Necessity and the Kantian Problem of Inference

The natural world is characterized by a lawful order and harmony. Tides occur at regular intervals, the lunar cycle is 29.5 days, and chemical substances have atomic numbers that explain a variety of their physico-chemical properties. Laws of nature seem to govern the natural world and to explain its robust regularities. Given Newton's law of gravity, and given the masses of the Earth and the Moon and their respective alignment, high tide *necessarily* follows. Given the laws of chemistry, the properties of aqua regia, and of gold, if thrown in aqua regia, gold *necessarily* dissolves.

Nomic necessity suggests that laws of nature go beyond Humean regularities and capture a robust modal thought: if C had been the case, *necessarily* E would have been the case. Modality has traditionally been invoked to distinguish between laws of nature and accidentally true universal generalizations such as "All fruits in Smith's garden are apples," where it is not a law of nature that were a seed thrown in Smith's garden, necessarily an apple tree would grow out of it.

How did Kant explain lawlike claims such as "Were the Earth and Moon aligned in a given way, high tide would *necessarily* occur"? In the *Critique of Pure Reason* Kant famously stated that the categories are concepts that prescribe laws a priori to nature "as the sum total of all appearances (*natura materialiter spectata*)" (B163). He then presented "a riddle" (I am henceforth going to call it the *Kantian problem of inference*). Namely, how can nature possibly follow the a priori laws that the understanding prescribes to it?

Since the categories are not themselves derived from nature, nor do they follow nature's patterns (otherwise they would be empirical and not a priori), it would seem preposterous to expect them to have any purchase on nature itself. This is the "riddle," as Kant outlined it. Nonetheless, we are told that the faculty of understanding *prescribes laws to nature*. Let us

state the problem more precisely. The Kantian problem of inference takes the following form:

- (I) All alterations occur in accordance with the law of the connection of cause and effect (Second Analogy).
- (II) Event of type A (e.g., alignment of the Moon and the Earth) causes event of type B (e.g., high tide occurring – empirical causal law).¹
- (III) Event A_1 causes event B_1 (e.g., this particular Moon–Earth alignment today causes high tides at Cramond Island at 11:35 a.m. – instantiated empirical causal law).
- (IV) A_1 occurs.
- (V) B_1 *necessarily* follows (necessity of effects, via I, II, and III).

For Kant, I argue, the causal connection at work in lawlike claims seems to follow this inferential pattern, which takes us from pure principles of the understanding such as (I) to specific events (i.e., V) via type–token empirical causal laws (II and III). The Kantian problem of inference² is the problem of how to proceed from a general premise such as Kant's Second Analogy of Experience (I) to the conclusion that *necessarily* high tide occurs at Cramond Island at 11:35 this morning (V), given that the Earth and Moon are aligned in a particular way today (IV).

The Kantian problem of inference is twofold. First, if the *understanding prescribes laws to nature*, lawfulness seems to be restricted to phenomena as objects of possible experience, and it does not extend to things in themselves. Thus, it would seem that the understanding prescribes laws to nature in a purely formal sense (*qua natura formaliter spectata*), that is, when nature is considered with respect to our formal conditions of the possibility

¹ There is a debate on how to interpret the Second Analogy (i.e., with a weak reading, “every event has a cause,” or a strong reading, “same event, same cause”). Here and in what follows, I understand the Second Analogy as implying the stronger reading “same event, same cause” (primarily defended by Guyer 1987).

² The terminology “problem of inference” is coined by van Fraassen 1989 in his critical treatment of David Armstrong's Necessitarian account of laws. In van Fraassen's use, the problem of inference is the problem of how to move from a necessitation relation between universal properties such as $N(F\text{-ness}, G\text{-ness})$ to the necessitation relation that is supposed to hold at the level of particulars $N(Fa, Ga)$; $N(Fb, Gb)$; and so on. I borrow the terminology, although – it should be clear from the passage above – the Kantian version of the problem of inference concerns how to go from a kind of necessity captured by the Second Analogy in its determination of the connection of appearances to the necessity that is supposed to hold in nature between events that we come to know via the Analogies of Experience, and more in general via the categories of the understanding. Thus, the Kantian problem of inference is even more pressing than its Armstrongian counterpart because it is the problem of explaining how to infer the necessity of particular lawful events in nature from the necessary determination of the connection of appearances that our faculty of understanding makes possible.

of experience. But the understanding would not prescribe laws to nature in any material sense, that is, in the sense of delivering on the promise of answering the question about how laws of nature can have a purchase on *nature itself*. Let us call this the *metaphysical quandary* of the Kantian problem of inference. The metaphysical quandary is not going to dissolve by appealing to transcendental idealism or the objective validity of the categories of the understanding. The thought of a purely formal nature being dependent on us, so that the necessity of effects would almost analytically follow from the causality expressed by the Second Analogy, is of course tempting in this context. But if this were indeed Kant's final and considered answer to the problem of inference, it would be bad news.

Recall our key question is: how did Kant explain lawlike claims such as "Were the Earth and Moon aligned in a given way, high tide would *necessarily* occur"? If it turns out that Kant's considered answer to this question (and similar ones) is that the understanding prescribes laws to nature qua sum of appearances that are (precisely because appearances) dependent on us, then it might well be possible that no tide will actually occur at the next Earth–Moon alignment (or that no tide would in fact ever have occurred at any Earth–Moon alignment) had it not been for our faculty of understanding imposing the Second Analogy on a relevant group of appearances.

Yet our key question has metaphysical import. It enjoins us to think that were the Earth and Moon aligned in a given way, high tide would *necessarily* occur (and indeed, it would necessarily occur even if there were no human beings advancing knowledge claims about tides and their lawlike occurrences). This is what I call the *metaphysical quandary* of the Kantian problem of inference.

Second, in the relevant passage of the *Critique of Pure Reason*, Kant is adamant that "Particular laws, because they concern empirically determined appearances, **cannot be completely derived** from the categories, although they all stand under them. Experience must be added in order to come to know particular laws **at all**; but about experience in general, and about what can be cognized as an object of experience, only those *a priori* laws offer instruction" (B165). Thus, it is not the case that the empirical laws of magnetism, or this particular causal law about tides (II), or any other, can be derived from the Second Analogy of Experience.

Instead, as Kant puts it, empirical causal laws simply "stand under" the categories and their principles, for example, the Second Analogy. I suggest that we see (II) as an instantiation of the general cause–effect template captured by the Second Analogy (I), pretty much as (III) is an instantiation of (II), in turn. Experience plays a role in our knowledge of these different

instantiations in a way that we need to clarify in the rest of this chapter. How can we then *come to cognize* the *necessity* of effects (V) as following from the general principle of causality expressed by (I)? Necessity attaches to the principle of causality via the Postulates of Empirical Thinking in General, which do not add anything to the content of the categories but only express “*the cognitive power whence it [concept] arises and has its seat*” (A234/B287). It is then unclear how one can *claim to cognize the necessity* of empirical causal laws, which can be derived neither from the understanding a priori nor from experience a posteriori. Let us call this the *epistemological quandary* of the Kantian problem of inference.

To answer both quandaries, I suggest we turn our attention to Kant’s discussion of grounds and modality and delve into Kant’s lectures on metaphysics so as to acquire a better grasp of his considered view on the nomic necessity of the laws.³ My final goal is to offer an account of the necessity of the laws of nature that I hope can make some progress on the Kantian problem of inference.

8.2 Three Kinds of Grounds and Three Kinds of Necessity in Kant

In this section, I turn to Kant’s lectures on metaphysics to clarify why, in my view, Kant’s considered answer to the problem of inference should be searched for in his multifaceted notion of ground and consequence. I clarify three different kinds of nomic necessity that Kant saw at play in different kinds of laws, each respectively relying on a different notion of ground, qua conceptual ground (“*ratio cognoscendi*”), qua ground of being (“*ratio essendi*”), or qua ground of becoming (“*ratio fiendi*”). Only the latter notion captures cause–effect relations at play in empirical causal laws, I argue.

In *Metaphysik Mrongovious* (written around 1782–1783),⁴ Kant called the relation of ground and consequence a connection “*nexus*” and distinguished between analytic or logical connection – as that “according to

³ In a seminal paper on Kant’s answer to Hume, Paul Guyer (2003a) has argued that since for Kant every judgment has a relation (it is either categorical or hypothetical), in the case of hypothetical judgments of the form “if *p* then *q*” Kant deployed the logical relation of *ground* and *consequence* without either clearly distinguishing it from the relation of cause and effect or including it in the table of categories. In what follows, I expand on Guyer’s distinction between grounds and causes so as to achieve a better grasp of both the metaphysical and epistemological quandary at stake in the Kantian problem of inference.

⁴ Kant did not leave his own lecture notes on metaphysics; all we have left is notes taken by his students. What is striking about these notes is the overlap of themes over the years and in notes taken by different students, so we can be confident enough that they reflect Kant’s genuine and sustained thoughts on the matter.

the principle of identity” – and what he called synthetic or real connection – “if it is not according to this principle” (29:807). Connections rest on grounds, which in turn can be either logical grounds or real grounds,⁵ depending on whether something is posited according to the principle of identity or not.⁶ For example,

extension is a ground of divisibility, the latter is posited through the former according to rules of identity, – but: every body has attractive power, here the latter is posited through the former (body), but not according to the rules of identity, and this connection <nexus> is real, the former logical. It is possible to cognize a real connection <nexus> only *a posteriori*. (29:807)

Mark these words. Kant starts with a general logical definition of ground as “that which, having been posited, another thing is posited determinately, the consequence is that which is not posited unless something else is posited” (29:808). Logical grounds underpin logical connections, that is, connections “according to the principle of identity.” I suggest reading logical grounds as cognitive grounds, or *rationes cognoscendi*, as when we infer divisibility from extension (or freedom from the moral law, see *CPrR* 5:004).⁷ More precisely, I suggest that we understand logical grounds as *conceptually* determining grounds (qua *ratio cognoscendi*) that deliver rules for inferring a conceptual consequence once a conceptual ground is posited. Using contemporary language, one might say that, for Kant, to be *conceptually necessary* is to be true in virtue of the nature of the concepts involved. Thus, the concept of a body’s divisibility is grounded in the concept of a body’s extension. Logical grounds qua *conceptually* determining grounds are inferentially deployed in lawlike judgments of the form:

- (i) Necessarily, if bodies are extended, they are divisible.

⁵ For a seminal analysis on real grounds, see Watkins 2005 and Warren 2001.

⁶ Kant develops this distinction further in *Metaphysik L₂* (dating back to 1790–1791), where he cashes out the distinction between logical grounds and real grounds as the distinction between “the relation of cognition, how one is inferred from the other” and the analogous relation in metaphysics where “ground belongs under the concept of causality” (28:548). In both cases, grounds bring along with them necessary connections with their consequences: “if I posit the ground, then a consequence must follow necessarily. A ground is that whereby, when it is posited, another thing is determinately posited <*ratio est id, quo posito determinate ponitur aliud*>” (28:549).

⁷ “Now we have a criterion of the ground, namely: that which, having been posited determinately, another is posited <*quo posito determinate, ponitur aliud*>. Determinately <*determinate*> means according to a general rule <*secundum regulam generalem*>. Every ground gives a rule, therefore the connection <*nexus*> of the ground and the consequence is necessary. (Logical ground is a cognition from which another follows according to a rule)” (29:808).

The necessity captured by (i) is what Kant calls the necessity according to the principle of identity for logical connections. We may want to call it *conceptual necessity*. That Kant saw (i) as expressing a conceptually necessary truth is clear from his pre-Critical defense of John Keill's theorem for the infinite divisibility of the space that bodies fill (with related geometrical demonstration) in *Physical Monadology* (PM 1:478).⁸

Conceptual necessity should not be confused with the necessity at play in theoretical identity statements, which take syntactically a form akin to (i) but express a very different kind of necessity:

(ii*) Necessarily, if something is water, then it is H₂O.

(ii**) Necessarily, if something is gold, then it has atomic number 79.

Or closer to Kant:

(ii ***) Necessarily, if a body has repulsive force, it is impenetrable.

Theoretical identity statements are *necessary a posteriori*, according to a very influential contemporary Kripkean account, because they deliver knowledge about the essence of things, and such knowledge is a posteriori (i.e., it is the result of a scientific discovery). Thus, in this sense the necessity of theoretical identity statements is not the necessity with which Kant's logical grounds qua *rationes cognoscendi* inferentially lead to their consequences: an experimental discovery is required to come to know that water is H₂O or that matter is impenetrable in virtue of its repulsive force.⁹ The necessity of theoretical identity statements is the necessity that attaches to the essence of water, the essence of gold, or the essence of matter, and for which, I suggest, we need to resort to another tool in Kant's arsenal, namely, grounds of being, or *rationes essendi*.

Kant's discussion of grounds of being is scant and not very illuminating. *Ratio essendi* sits uncomfortably between logical grounds and (proper) real grounds as grounds of becoming (*ratio fiendi*). In what follows, I give my own (arguably fallible) reading of Kant on *grounds of being* and *grounds of*

⁸ The notion of *ratio cognoscendi* features already in the 1755 pre-Critical text *New Elucidation* but in a slightly different way. For it is there identified with what Kant calls "consequently determining reason," which is one of the two possible expressions of the Leibnizian principle of sufficient reason (or better, principle of determining reason, as Kant calls it), rather than just a logical ground as in the aforementioned quotes from the much later, Critical-period metaphysics lectures.

⁹ Odd as it might sound to our contemporary ear, Kant regarded impenetrability as an essential property of bodies as much as we would now regard atomic number 79 an essential property of gold. For Kant matter was defined as that which fills a space and resists penetration. Hence the sentence "Bodies are impenetrable" would enjoy – I contend – a status that is akin to our contemporary theoretical identity statements about gold and water.

becoming, and how I see both of them at work in two further kinds of nomic necessity that Kant seems to be subscribing to.

If one is asking not whether a concept is the ground for inferring another concept, but rather “how a thing is the ground of other things,” that is, how it is possible that “if one thing is posited, the other can be determined by it” (29:809), one must turn to metaphysics rather than logic. Thus, real grounds (properly speaking) capture an entirely different class of lawlike claims: those where, if a ground is posited as a *cause*, a consequence follows as an *effect*, and not just logically or conceptually but *existentially*.¹⁰ Kant calls a real ground qua cause “the ground of becoming *<ratio fiendi>*,” not to be confused with the ground of being *ratio essendi* as “the ground of that which belong to a thing considered according to its possibility, for example, the three sides in the triangle are the ground of the three corners” (ibid.).

I take Kant’s *ratio essendi* to denote essential properties of things. For example, it is an essential property of triangles to have three sides, and once that is posited the possibility of three corners is also posited because they are both properties that pertain to the essence of triangles.

Using modern notation,¹¹ one might be tempted to write Kant’s *ratio essendi* as follows: $\Box_x p$, namely, *p obtains in virtue of what it is to be x*. Grounds of being as *ratio essendi* capture not just geometrical claims such as the one above about triangles. But – I contend – they capture any lawlike claim that pertains to the *possible determinations* of the essence of a thing. In *Metaphysik* L_I (one of Kant’s early sets of lecture notes from the mid-1770s) Kant distinguished between the *nature* of a thing and the *essence* of a thing:

The inner ground [of that] which belongs to the actuality of a thing is *nature*, but what belongs to the possibility and to the concept of the thing is *essence*. A triangle has no nature, for it is no actuality, but rather only shape, thus in all of geometry there is no nature . . . The essence of a body is that which belongs to its concept; but nature [is that] by which all phenomena can be explained. What is general in the nature of bodies, what contains the

¹⁰ “The two concepts of ground and consequence are logical but not transcendental. Cause and effects are things. Cause is that out of which the existence of another follows. Existence is not at all discussed in logic” (29:809).

¹¹ For this notation, see Fine 1994, 2012; Correia 2011; and Rosen 2010. In modern wording, one would read the grounding operator $\Box_x p$ as follows: “it lies in the nature of *x* that *p*.” But since Kant – as I am going to clarify below – sharply distinguished between the *essence* of things and the *nature* of things, to avoid terminological confusion between Kant’s vocabulary and the modern one, let us read the grounding operator $\Box_x p$ as “*p obtains in virtue of what it is to be x*.” See Chapter 7 in this volume for additional textual evidence about Kant’s view on the “nature” of a thing.

principle of all phenomena, is very little, namely impenetrability, connection, and shape. (28:211)

In *Metaphysik* L₂ (written in 1790–1791, around twenty years after *Metaphysik* L₁) Kant further elucidates the difference between a *logical essence* as “the first ground of all logical *predicates* of a thing” and a *real essence* as “the first ground of all *determinations* of an essence” (28:553). While logical essences require the analysis of all predicates that lie in any given concept, real essences are found through the principles of synthesis and are “the first inner ground of all that which belongs to the matter itself”:

The real essence is not the essence of the concept, but rather of the matter. E.g., the predicate of impenetrability belongs to the existence of a body. Now I observe through experience much that belongs to its existence; e.g. extension in space, resistance against other bodies, etc. Now the inner ground of all this is the nature of the thing. We can infer the inner principle only from the properties known to us; *therefore the real essence of things is inscrutable to us*, although we cognize many essential aspects. We become acquainted with the powers of things bit by bit in experience. (28:553).

Thus, although we can never know the real essences of things, we become familiar with “the powers of things bit by bit” in experience. We come to cognize by experience essential properties or *determinations that belong to the existence of a body*, for example, that bodies resist penetration from other bodies and attract other bodies too. From these properties or determinations known to us, we infer the “inner ground,” or what Kant calls the “nature of the thing.” Thus, from fermentations and chemical and optical phenomena that Kant was well familiar with and to which he repeatedly referred in *Universal Natural History*, *On Fire*, *Physical Monadology*, and again *Metaphysical Foundations*, we come to infer that there must be a repulsive force as a power that allows bodies to resist penetration, saltpeter to burn in the bowels of the Sun, winds to form when there is a decrease in the expansive force of the air, and so on.¹²

In a quasi-Kripkean fashion, a theoretical identity statement such as (ii***) would then display a kind of necessity, which is better called *metaphysical necessity* because it is grounded in the essential determinations or powers of matter. I take Kant’s “ground of being” qua *ratio essendi* to support two (weak and strong) modal claims:

¹² For details about Kant’s take on repulsive force in these phenomena, see Massimi 2011. For an analysis of Kant’s notion of “nature” of things and its relation to explanatory laws, see Ameriks’s (2012) treatment in the chapter “Kant and the End of Theodicy.”

***Ratio essendi* weak modal claim:**

Given an essential property *F* that obtains in virtue of what it is to be *x* (qua ground of being), positing *x* metaphysically grounds the possibility of *F*.

For example, given that having three corners is an essential property that obtains in virtue of what it is to be a triangle *x* (qua ground of being), whenever we posit *x*, we posit also the possibility of having three corners. Or, to use a different example, given that resisting penetration is for Kant an essential property that obtains in virtue of what it is to be matter *x* (qua ground of being), by positing *x* the possibility of impenetrability *F* is also posited.¹³

Kant would presumably endorse an even stronger claim whereby, whenever the ground of being for triangles is posited, *necessarily* the possibility of the essential property of three corners is also posited. Similarly, whenever the ground of being for matter is posited, *necessarily* the possibility of the essential property of impenetrability is posited with it:

***Ratio essendi* strong modal claim:**

Given essential property *F* that obtains in virtue of what it is to be *x* (qua ground of being), it is necessary that positing *x* metaphysically grounds the possibility of *F*.

I take the *Ratio essendi* strong modal claim to be at work in theoretical identity statements such as “Water is H₂O,” or “Gold is element with atomic number 79,” or, closer to Kant, “Triangles have three corners” or “Bodies are impenetrable.” Theoretical identity statements are *necessary a posteriori* because the fact that it is in the essence of material bodies to resist penetration *metaphysically grounds* the possibility of impenetrability, and necessarily so (according to the *Ratio essendi* strong modal claim).

Things get complicated with real grounds qua *causes* or *rationes fiendi*. In light of Kant’s aforementioned distinction between essence and nature, Kant seems to be suggesting that if something obtains in virtue of what it is to be a real ground qua *ratio fiendi*, then it is not just the possibility of some essential property *F* that is grounded in the obtaining of the ground *x* (and necessarily so). Instead, by positing the real ground, a whole host of lawful

¹³ The *ratio essendi* weak modal claim does not contend that the possibility of *F* is included in actuality of *x* (or better, in the actuality of what it is to be *x*). It simply tells us that *if F* obtains in virtue of what it is to be *x*, then positing this essentialist claim metaphysically grounds the possibility of *F*. Whether or not there exists a *ground* in actuality that indeed metaphysically grounds the possibility of *F* falls outside the scope of what the *ratio essendi* weak (and strong) modal claims can ever teach us. As we will see shortly, telling us whether or not there exists such a *ground* is the job of the *ratio fiendi*’s first modal move.

phenomena are *causally grounded*, and necessarily so. This necessity of synthetic connections, Kant adds, is baffling. No human reason can comprehend it, and it cannot be grasped by experience either: "That which the real ground contains of something is called *cause*. I can *not* comprehend the concept of real ground from experience; for it contains a necessity" (28:549). What kind of necessity do real grounds (*rationes fiendi*) deliver?

It is not the conceptual necessity licensed by logical grounds, because the principle of causality bridges antecedents and consequents in lawlike claims *synthetically*, that is, without the concept of the consequent being already included in the concept of the ground. It is not metaphysical necessity either, licensed by grounds of being or *rationes essendi*, because the necessity of "grounds of becoming" undergirds lawlike claims that are *not* confined to the possible essential determinations of things (and necessarily so; e.g., matter being impenetrable, and necessarily so). Instead, the necessity of "grounds of becoming" undergirds lawlike claims that go from the *actual* obtaining of something qua *cause* to the *actual* obtaining of something else qua *effect in nature*.

Real grounds qua *rationes fiendi* then capture modal connections, whereby the real ground is a *causal* ground for the necessary occurrence of the consequent: facts featured in the antecedent of the "if . . . then" claim are *causal grounds* for the consequent facts obtaining. This kind of necessity is neither conceptual nor metaphysical. It is *natural*, I contend.¹⁴ For real connections to be *naturally necessary* is for them to be true in virtue of what Kant calls the "nature of the things" (and not the essence of the things, since for Kant *essences* give only the grounds for the possibility of things, but *natures* give grounds for the actuality of things). For example:

- (iii*) Necessarily, if the Earth has attractive force, then the Earth has a spherical shape.
- (iii**) Necessarily, if air has repulsive force, then air produces winds.

These statements are necessary because – to Kant's eyes – the consequent obtains in virtue of positing attractive or repulsive forces that *cause* the Earth to acquire its spherical shape, or *cause* air to produce winds, respectively. And attractive and repulsive forces are essential properties or powers that belong to the *nature* of matter. While the necessity associated with logical grounds is what I have called *conceptual necessity*, and the necessity

¹⁴ Natural necessity is not one and the same as metaphysical necessity, for the latter subdivides into other nonnatural kinds of necessity, such as normative necessity (for a classic contemporary treatment, see Fine 2002).

associated with grounds of being, or *rationes essendi*, is what I have called *metaphysical necessity*, I contend that the necessity that is to be found in most empirical causal laws is the *natural necessity* typical of real grounds qua *rationes fiendi*.

Equipped with this threefold distinction of grounds qua *ratio cognoscendi*, *ratio essendi*, and *ratio fiendi*, and their respective kinds of necessity, we can go back to the *metaphysical quandary* associated with the Kantian problem of inference and provide an answer to it on Kant's behalf.

8.3 Solving the Kantian Problem of Inference: *Causal Grounds* and Their Triple Modal Move

Recall the metaphysical quandary. Kant's famous claim about the understanding prescribing laws to nature seems *prima facie* to confine lawfulness to phenomena as objects of possible experience. Thus, it would seem that the understanding prescribes laws to nature in a purely formal sense (qua *natura formaliter spectata*), but not in any material sense, that is, in the sense of delivering on the promise of nomic necessity that would easily answer the question about how laws of nature can possibly have a purchase on *nature itself*.

The analysis in the previous section makes us well equipped to go back to this quandary and offer a possible solution to it. Laws of nature – I argue on Kant's behalf – have a purchase on *nature itself* because they express the way in which once real grounds are posited, consequences necessarily follow. Real essences are inscrutable to us (hence the lawfulness of things in themselves goes beyond the boundaries of our experience). Yet we do cognize many essential properties or determinations of things, or what Kant also calls “the powers of things,” such as attractive and repulsive forces. These powers of things, or essential determinations that belong to the existence of matter, are rooted in real grounds qua *causal grounds* for the consequent facts obtaining.

Under the broadly dispositional essentialist reading that I am going to suggest on Kant's behalf,¹⁵ Kant would be concerned with how some essential properties or powers – grounded in the “nature of things” qua real grounds (*rationes fiendi*)¹⁶ – result in laws of nature that have a

¹⁵ This reading follows up on Massimi 2014. For a further dispositional essentialist reading of Kant and laws, along lines that are slightly different from mine, see Chapter 7 in this volume.

¹⁶ On my reading here, the “natures” of things (or *rationes fiendi*) are not one and the same as the causal powers of things. Instead they ground the latter, in the sense of providing *metaphysical grounding* for

purchase on nature itself via a triple modal move. Kant calls these essential properties “*essentialia*” (28:553) or, alternatively, “the powers of things,” and he takes attractive and repulsive forces as the two main examples. He is committed to the view that these essential properties or powers are not quiddities, whose identity is primitive and cannot be further explained or grounded in anything else.¹⁷ Instead, he seems to suggest that those essential properties or powers have an “inner ground” or what he interchangeably calls a “real ground,” which is in turn the “nature of the thing” (I am going to call it *z* to distinguish it from ground of being *x*), whose role – I take it – is to *metaphysically* ground these essential properties.¹⁸ Hence, Kant’s view is essentialist in bringing in the “nature of the thing” with the following first modal move, which I am going to call the *Ratio fiendi* first modal move:

***Ratio fiendi* first modal move:**

There exists a real ground *z* such that essential property or power *F* obtains in virtue of what it is to be *z*. Hence, by positing *z* as a real ground, essential property, or power, *F* is also determinately posited.

For example, there exists a real ground *z* of, say, matter such that all material bodies have the power of resisting penetration.¹⁹ This first modal move captures the metaphysical necessity of essential properties or powers *F*, which for Kant are not quiddities but have an inner ground/real ground

essential determinations or powers of things. Hence the first *essentialist* component of my triple modal move here.

¹⁷ Thus, Kant’s view differs from what is now called categoricism, i.e., the view that underlies contemporary Humean metaphysics à la Lewis no less than Necessitarian accounts such as Armstrong’s. Categoricism maintains that the fundamental natural properties are categorical, rather than dispositional: their identity is defined by a quiddity, not by their possible causal roles (as in the case of dispositions). Categorical properties may be instantiated in nature with very different causal roles, without yet losing their identity, which is secured by quidditism. Hence the laws of nature where categorical properties feature are metaphysically contingent. That is not the case with dispositional essentialism: a dispositional essential property is always instantiated with the same causal role (no matter what the actual manifestations are) because it is identified by such a role (and not by some nonexplicable quiddity). For an excellent introduction see Choi and Fara (2016).

¹⁸ I take it that both *rationes fiendi* and *rationes essendi* have the primary task of metaphysically grounding essential properties, but with two main differences. First, *rationes essendi* metaphysically ground the possibility of essential properties, whereas *rationes fiendi* metaphysically ground the actuality of essential properties (recall the difference Kant draws between essence and nature). Second, and related to my first point, the class of essential properties whose possibility is metaphysically grounded by *rationes essendi* is larger than the class of essential properties whose actuality is metaphysically grounded by *rationes fiendi* (e.g., the former includes geometrical properties such as triangularity, among others).

¹⁹ I take Kant to be subscribing to this first modal move because he takes real grounds as grounds of actuality and not just grounds for the possibility of some essential properties (recall quotes 28:211 and 28:553).

z in what he calls the “nature of the thing.” To reiterate: Kant does not identify real grounds (z) and essential properties (or powers) (F). Nor does he consider essential properties as sheer predicates that can be attributed to things. Real grounds qua *rationes fiendi metaphysically ground* the actuality (and not just the possibility) of essential properties or powers – this is what the *Ratio fiendi* first modal move tells us. But we are not simply interested in the metaphysical necessity with which essential properties or powers are actually posited, whenever real grounds are posited. What is distinctive and unique about real grounds qua causes are the further modal claims they make possible.

Indeed, not only is Kant endorsing the *Ratio fiendi* first modal move concerning essentialism about properties or powers. He is also endorsing – I contend – a further modal claim that explicates the properly *dispositional nature* of his essentialism.²⁰ Following dispositional essentialism as the view that an essentially dispositional property manifests a given behavior in the presence of the right stimulus condition,²¹ I suggest that we understand Kant’s argument as implicitly buying into the following dispositionalist modal move:

***Ratio fiendi* second modal move:**

There exists a real ground z such that it is in virtue of z that each object a that has it also has the essential property or power F (as per the *Ratio fiendi* first modal move); and this fact, in turn, causally grounds the dispositional behavior D of any object a .

For example, the elasticity of material bodies $a_1 \dots a_n$ is a disposition D that is causally grounded in the repulsive force as an essential power F that lies in the real ground z of any material body a .

Kant clearly saw the relation between real grounds, essential properties or powers, and their manifestations along these dispositionalist essentialist lines. Real grounds pertaining to the nature of things undergird powers that in turn *causally ground* dispositional behavior D . For example, repulsive force as an essential determination of matter is manifested in “the self-same elasticity and pressure of the air,” which is in turn “of necessity the

²⁰ Here I fully endorse Barbara Vetter’s 2012 distinction between (1) some fundamental properties are essential, and (2) some of these essential properties are dispositional. E.g., the essential property of having three sides for triangles is not dispositional, but the essential property of repulsive force for material bodies is dispositional.

²¹ According to a sophisticated conditional analysis of dispositions, object a has a disposition D to manifest M in the presence of the right stimulus condition S iff a has some essential property (or power F) that would *cause* a to manifest M in the presence of S (for this conditional analysis of dispositions, see Lewis 1997). I return to the importance of M and S below in the *ratio fiendi* third move.

ground of the possibility of pumps, of the generation of clouds, of the maintenance of fire, of the winds, and so on. It is necessary that, as soon as the *ground* of even merely one of them be present, the *ground* of the others should also be present" (*OPA* 2:106, emphasis added). In other words, as soon as we posit repulsive force (F) as a power that lies in the nature of a thing (or in its real ground z), we will see F causing the dispositional behaviour of elasticity (D) that is at work in many effects wherever z is present (i.e., the generation of the clouds, the maintenance of fire, the production of the winds, and so forth).

Following a long tradition that goes back to Newton and Hales, among others,²² Kant thought, for example, that the repulsive force was an essential power that belonged to the existence of air. Along similar lines in the *Metaphysical Foundations*, he declared, "The expansive force of a matter is also called *elasticity*. Now, since it is the basis [*Grund*] on which the filling of space rests, as an essential property of all matter, this elasticity must therefore be called *original*, because it can be derived from no other property of matter. All matter is therefore originally elastic" (*MF* 4:500). Similarly for attraction: "The *attraction essential to all matter* is an immediate action of matter on other matter through empty space . . . This original attractive force contains the very ground of the possibility of matter, as that thing which fills a space to a determinate degree, and so contains even [the ground] of the possibility of a physical contact thereof" (*MF* 4:512).

Finally, to complete Kant's response to the metaphysical quandary, we need a further modal claim that links dispositional essential properties (e.g., the elasticity due to the repulsive force or the action at a distance due to the attractive force) with their very many manifestations in nature. To achieve this goal, I suggest that we unpack the *Ratio fiendi* second modal move to allow for what Alexander Bird (2007), following Gilbert Ryle, calls "multi-track dispositions," that is, dispositions $D_{(S,M)}a$ that have various manifestation conditions M under slightly varied stimuli conditions S .²³

***Ratio fiendi* third modal move:**

There exists a real ground z for essential property or power F , which causally grounds the dispositional behavior D of any object a having z as

²² For details, see Massimi 2011.

²³ Multi-track dispositions have more than one pair of manifestation M and stimulus S condition (although they must share the same notion of stimulus condition). Being elastic is an example of a multi-track disposition because it can have more than one pair. Its stimulus condition can be being released, being stretched, being pulled, being twisted. Its manifestation condition can be being inflated, being bounced back, being squiddy, being resistant, and so on.

its real ground and F as an essential power, so that in different stimuli conditions S , different manifestations M of disposition D occur.

Under slightly varied stimuli conditions $Sa_1 \dots Sa_n$, the repulsive force F – as a multiply instantiable essential power grounded in z – displays a multi-track disposition $D_{(S,M)}a$, that is, elasticity (depending on whether it is the elasticity released by the atmospheric air, the elasticity inherent in colliding balls, or the elasticity of a stretched spring, and so on). This multi-track disposition *necessarily* yields a variety of manifestations M . For example, Ma_1 , that is, winds are produced when elasticity decreases and causes alteration in the equilibrium of the atmosphere;²⁴ Ma_2 , that is, fire burns when elastic air is released by saltpeter in the bowels of the Sun;²⁵ Ma_3 , that is, a spring recoils when its elastic material is being pulled; and so forth. What all these different phenomena share is a common real ground z in virtue of which an essential power F obtains (e.g., repulsive force), such that F causally grounds a multi-track disposition $D_{(S,M)}a$ (e.g., elasticity), which under different stimuli conditions necessarily brings about different manifestations M .

To sum up, the three modal moves I have suggested are designed to deliver a three-tier causal basis for multi-track dispositions in Kant's metaphysics. Real grounds are the first tier. Essential properties or powers F are the second tier. Multi-track dispositions are the third tier.²⁶ More to the point, the essential properties or powers of the second tier are not sparse categorical properties, because (1) Kant rejects quidditism and grounds these properties in real grounds (as per *Ratio fiendi* first modal move). Moreover, (2) Kant identifies these essential properties or powers with their causal roles in bringing about multi-track dispositions (as per *Ratio fiendi* second and third modal moves). As for real grounds themselves, they are neither categorical nor dispositional properties – indeed they are not properties at all but instead grounds for powers (and ultimately for the dispositions that supervene on them).

²⁴ In his 1756 *Theory of the Winds* the cause of the winds was itself identified with the “decrease of the expansive force by cold and vapors that reduce the elasticity of the air” (1:491).

²⁵ In *Universal Natural History*, Kant described elasticity or, better, “elastic air” as “capable of maintaining the most violent degrees of fire” in the atmosphere of the sun (1:325–326).

²⁶ According to an influential view by Prior, Pargetter, and Jackson (1982), dispositions have a causal basis, which is typically constituted by a set of properties. Whenever an object has this set of essential properties and is in the right stimulus condition, it is causally necessary that the object manifests dispositional behavior D . Critics have objected that if the causal work of necessitating the manifested behavior is done by the causal basis of properties, dispositions are causally inert and redundant. I hint at an answer to this objection below (at least in the context of my analysis of Kant's view).

If this analysis is correct, a new picture emerges about Kant's view on the necessity of laws. For multi-track dispositions are ultimately grounded on real grounds all the way down. Moreover, it is this three-tier structure of real grounds, essential properties or powers, and dispositions that ultimately cause (and necessarily so) the stimulus–manifestation pairs. The essential power of repulsion (in and of itself) neither causally explains nor necessitates that saltpeter should burn inside the Sun or that winds should form by decreasing the elasticity of the air. For any stimulus–manifestation pair, the three-tier system of real grounds, essential powers, and multi-track dispositions must be present.²⁷ And it is this three-tier system that ultimately makes laws of nature *necessary* and *part of a unified system of laws*, I contend.

We are now equipped to go back and solve the metaphysical quandary and explain why, on Kant's account, laws have a purchase on nature and can *necessitate* states of affairs, despite the fact that the understanding prescribes laws to nature in a purely formal way (*qua natura formaliter spectata*). How does the inference from (I) to (V) proceed?

- (I) All alterations occur in accordance with the law of the connection of cause and effect (Second Analogy).
- (II) Event of type A (e.g., alignment of the Moon and the Earth) causes event of type B (e.g., high tide occurring – empirical causal law).
- (III) Event A_1 causes event B_1 (e.g., this particular Moon–Earth alignment today causes high tides at Cramond Island at 11:35 a.m. – instantiated empirical causal law).
- (IV) A_1 occurs.
- (V) B_1 *necessarily* follows (necessity of effects, via I, II, and III).

On the reading I have been suggesting, we should understand empirical causal laws in (II) as instantiations of the principle of causality in (I), where, by experiments and observations, we learn how to fill in the general template of cause–effect relation offered by the Second Analogy of Experience (I) with real grounds and their essential powers (e.g., attractive force and repulsive force). These, in turn, causally ground dispositions D that we see manifested in nature in a variety of

²⁷ A bonus of my present analysis is that it defuses the aforementioned objection about the causal inefficacy of dispositions. For it is not the case that all the causal work is done by the causal basis of properties leaving dispositions redundant. The causal basis of essential properties or powers is itself metaphysically grounded in real grounds. And it is only via the triple *ratio fiendi* modal move here described that stimulus–manifestation pairs occur and the empirical causal laws associated with them acquire nomological strength.

phenomena (e.g., balls colliding, fire burning, winds forming, and so on). That is why Kant says that empirical causal laws cannot be completely derived from the faculty of understanding (although they “stand under it”) and that experience is required instead to learn the “powers of things bit by bit.” Moreover, experience is required to fill in the details of how, under different stimuli conditions $Sa_1 \dots Sa_n$, the multi-track disposition $D_{(S,M)}a$ yields different manifestations $Ma_1 \dots Ma_n$ in the *Ratio fiendi* third modal move.

More precisely, experience enters (II) via the *Ratio fiendi* second modal move where we learn by experience and observation about these powers and conclude that there exists a real ground z for them.²⁸ Thus, the inference from

- (I) All alterations occur in accordance with the law of the connection of cause and effect (Second Analogy).

to

- (II) Event of type A (e.g., alignment of the Moon and the Earth) causes event of type B (e.g., high tide occurring – empirical causal law).

takes place by filling in the general causal template in (I) (i.e., “All alterations occur . . .”) with the details of a specific power F (e.g., attractive force in this example) – and the existence of z as its real ground (i.e., the “nature” of mass) – which *causally grounds* the dispositional behavior Da_i of massive bodies (e.g., Earth and Moon) to attract each other, as per the *Ratio fiendi* second modal move. Experience teaches us what specific kind of cause–effect connection (e.g., attraction between the Earth’s mass and the Moon’s mass) is in place when we observe alterations in the low and high tides at Cramond beach. Experience does not tell us that the alterations are necessary, of course. Nor does the Second Analogy tell us that either (if not in some weak, transcendental sense that does not solve the Kantian problem of inference). The necessity of the effects must then come from somewhere else.

Experience and observation enter also (III) via the *Ratio fiendi* third modal move, where by experience we learn how to track multiple effects

²⁸ The *Ratio fiendi* first modal move is somehow included into the *Ratio fiendi* second modal move, because its role is that of expressing the essentialist nature of these dispositional properties, which are not quiddities. As such, *Ratio fiendi* first modal move does not itself feature in the inference from (I) to (II).

under a common power F and its multi-track disposition D that we see manifested in various events M in nature. In other words, the inference from (II) to (III) “Event A_1 causes event B_1 ” (e.g., this particular Moon–Earth alignment today causes high tides at Cramond Island at 11:35 a.m. – instantiated empirical causal law) takes place by filling in the specific stimulus conditions $Sa_1 \dots Sa_n$ under which the power F may find itself operating (e.g., no interference due to another massive planetary object in the Moon–Earth alignment; positions of the Sun and the Moon relative to the Earth today; position of the Moon with respect to the Earth’s equator today, and so on). Once these stimuli conditions are “filled in,” necessarily high tide at Cramond Island occurs at 11:35 a.m. today (Ma_1), as premise (III) says, via the *Ratio fiendi* third modal move. By the same token, necessarily the Earth’s rotational velocity decreases over millions of years (Ma_2); necessarily coastal lines and ocean depths in both hemispheres are affected over centuries (Ma_3); and so forth. That is where the necessity of effects ultimately comes from: from the triple modal move of Kant’s dispositional essentialism.

From these diverse manifestations of a multi-track disposition by simple modus ponens, whenever the right stimulus condition Sa_1 is present (premise IV), the manifestation Ma_1 necessarily follows (necessity of effects – conclusion V). The nomic necessity of most empirical laws, under this dispositional essentialist reading of Kant, is nothing but the expression of the natural necessity through which real grounds, and their powers qua dispositional essential properties, *causally* determine a variety of consequences in nature.

If this interpretation is on the right track, it might go some way toward explaining Kant’s emphasis on the unity and systematic order of nature, according to which, once a real ground is posited for some effect (e.g., saltpeter’s combustion inside the Sun), the ground of other effects (e.g., the production of winds) is posited too.

A dispositional essentialist reading of Kant on laws can solve at once the problem with the seemingly mysterious inference from (I) to (V). For it explains the necessity of the effects *in nature* via the triple modal move captured by the essentialist, the dispositional, and finally the multi-track dispositions associated with real grounds. The understanding prescribes laws to nature by providing templates of cause–effect (but also others, e.g., persistence of substance at work in the conservation of mass) that by experience and observation we learn how to “fill in” with dispositional powers, their inferred real grounds, and necessary consequences. Empirical causal laws prescribe the way nature ought to be by capturing natural

necessities in the manifested behavior of real grounds qua dispositional essential properties of things, whose ultimate real essences remain unknown to us. That is why, despite the lawfulness of things in themselves being precluded to us, the lawfulness of appearances is more than just a projected or injected lawfulness. It is instead a robust lawfulness undergirded by nature's real grounds, their powers, and related modal claims.

8.4 Concluding Remarks

The main goal of this chapter was to advance an interpretation that could vindicate Kant's bold claim that the understanding prescribes laws to nature. To this end, I have elucidated the metaphysical aspect of the dispositional essentialist reading that I am defending on Kant's behalf with an eye to clarifying different kinds of necessity that Kant seems to be referring to in various passages of the lectures on metaphysics. We identified three main notions of necessity (conceptual, metaphysical, and natural necessity, respectively). They are, respectively, at work in conceptual truths, theoretical identity statements, and empirical causal laws, via three different kinds of grounds (*ratio cognoscendi*, *essendi*, and *fiendi*). This taxonomy is far from exhaustive and is meant only to map out (tentatively) the territory of lawlike claims and their necessity in Kant.

The nomic necessity at play in the majority of empirical laws of nature, I have claimed, is *natural necessity* captured by real ground–consequence relations. I have clarified three modal moves that are involved in the way in which real grounds qua *rationes fiendi* bring about their effects in the harmonious and essential order of nature, an order that is ultimately subsumed under God, yet nomically independent of Him, to Kant's eyes.²⁹

The metaphysical quandary of the problem of inference evaporates at once. The faculty of understanding has a purchase on nature because it provides general templates under which stand many empirical laws. And, crucially for my story, these laws capture the natural necessities with which dispositional essentialist properties bring about their effects.

²⁹ "The forces of nature and the causal laws which govern them, contain the ground of an order of nature. This order of nature, in so far as it embraces a complex harmony in a necessary unity, has the effect of turning the combination of much perfection in *one* ground into a law. Thus, different natural effects are, in respect of their beauty and usefulness, to be regarded as subsumed under the essential order of nature, and, by that means, as subsumed under God" (*OPA* 2:107). On this point, see Massimi 2014.

Thus, nomic necessity qua natural necessity supervenes on nature's essential powers and their dispositional behavior. While the underpinning metaphysics of my reading of Kant on laws is dispositional essentialist, it should also be clear that for us to *cognize the necessity* of the laws, that is, to stumble into empirical regularities and identify them as modally robust (as we expect laws of nature to be), they *ought to stand under the laws of the understanding* and "fill in" the general templates provided by the System of the Principles.

Kant knew that Humean regularities are where one wants to find them. What makes some of them laws of nature (while others are not) is precisely the fact that some of them are undergirded by grounds and their necessary effects, while accidentally true ones are not.³⁰ The *Ratio fiendi* triple modal move presented in Section 8.3 shows how to move from general principles of the understanding to instantiated empirical laws, whose necessity is not "injected" or downstream to the necessity of the principles themselves. It is instead grounded in the natures of the things and their dispositional essentialist powers, which we come to know "bit by bit" by experience.³¹

Turning to the epistemological quandary, we *can cognize the necessity* of empirical causal laws (which is derived neither a priori from the understanding nor a posteriori by experience), because these laws "stand under" the formal template of causality, under which only it is possible for us to carve nature's empirical manifold according to modally robust regularities. The quandary was based on erroneously conflating the necessity (qua Postulate of Empirical Thinking) that attaches to the principle of causality, with the nomic necessity that – under my interpretive reading – Kant saw as natural necessity under a dispositional essentialist view of real grounds. The former provides only necessary rules for ordering our representations according to cause–effect. The latter is evidenced by the plurality of effects traceable to the same real ground in nature.³²

³⁰ "But there are cases where something is posited, and another thing is posited after, yet where the one is not a ground of the other. E.g., when the stork comes, good weather follows. But to posit [*ponere*] does not mean something follows the other accidentally; for the stork could also be brought on the mail coach" (28:549).

³¹ Hence my metaphysical picture of powers and natural necessity differs in significant ways from Friedman's reading of causal laws whose necessity is injected from the necessity of the Second Analogy and, more generally, of the principles of the understanding as constitutive a priori for our experience of nature (see Friedman 2014 and Chapter 10 in this volume).

³² My account of natural necessity would then be compatible with readings of Kant that place emphasis on the principle of systematicity (esp. in the third *Critique*) as a way of understanding

What ultimately allows us to encounter nature as ordered, lawful, and harmonious is our ability to cognize (neither the essences nor the nature of things but) the multifarious manifestations of the powers of things “bit by bit.” The faculty of understanding, I suggest, offers nomological cookie-cutters with which we learn how to carve out the empirical manifold at its joints, namely along the lines of its natural necessities. In this sense, and in this sense only, I conclude, can Kant successfully (and nontrivially) claim that our understanding prescribes laws to nature, a nature that never ends to manifest itself as ordered, lawful, and harmonious in its seasonal and daily regularities.

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why particular regularities count as laws (insofar as they are part of a system of empirical laws). Yet I part ways with these readings because I do not see the nomic necessity of the empirical laws as *itself* a consequence of being part of a system of laws (for reasons that I discuss elsewhere; see Massimi, forthcoming). Thus, I share with these readings of systematicity the idea that *lawlikeness* (if understood as an epistemic feature of *cognizing* some regularities as laws) might well be a function of them being part of a system of laws. E.g., *our ability to cognize* the attraction between the Earth and the Moon as *lawlike* in causing tides has to do with us having a system of Newtonian mechanics in place; in another world *w/* where no such system were in place, the same phenomenon could not be cognized as lawlike. But I diverge from these readings of systematicity in contending that the *lawfulness* (understood as a metaphysical feature of why some regularities are indeed laws of nature) has nothing to do with them being part of a system of laws. According to the view defended in this chapter, in another world *w/* where Newton’s system were not in place, the attraction between the Earth and the Moon would still be lawful for Kant, because it would still be the expression of the natural necessity with which once gravity is posited, tidal effects necessarily occur.